OSTEOPLASTIC RESECTION OF THE SKULL BY MEANS OF A NEW TREPHINE.[1]

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Various methods are practised for effecting an opening into the cranial cavity. The one most frequently used is the old operation of trephining. This plan will probably always be the method of choice in the majority of cases. It exposes, however, but a small area for inspection and for operation, and, if it is necessary to expose a large area, the bone around the trephine opening must be cut away with rongeur forceps. When such an operation is finished, a large gap is left in the skull; and, because of the fear of hernia cerebri and of apprehension as to future injury from without, various ingenious methods have been practised to effect a closure of the opening.

The osteoplastic method of resection of the skull, originally suggested by Wolff and put into practical execution by Wagner in 1889, makes an opening into the skull by cutting what is practically a trap-door in the bone. This trap is held open, the operation is completed, and the trap is replaced. In certain cases such a method is distinctly advantageous. It enables us to expose as large a surface as may be necessary, because a large bone-flap of this description will unite, when returned to place, as easily as a small one. The osteoplastic method is the one chosen in most exploratory operations, where we fancy that there may be a tumor; in some operations for the removal of known tumors, and in operations for epilepsy.

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The bone-flap is usually cut by the use of chisels or gouges of special construction. It takes a long time to complete the chiselling, and the employment of the mallet or hammer may, by repeated tapping or more violent jarring, injure the nervous structures within the skull. In such a condition as abscess of the brain, hammering may lead to diffusion of the abscess; if hæmorrhage exists, it may increase it or it may cause hæmorrhage; and in using a chisel there is always some danger that a fracture will extend out far beyond the point which we desire cut. Many surgeons feel apprehensive in using the chisel and mallet for opening the skull. It is my personal belief that the hammer increases the shock and distinctly adds to the risk of the operation.

In order to avoid this risk, some surgeons cut an osteoplastic flap by means of the Gigli saw. To use this saw, it is necessary, first, to make several or a number of trephine openings. To do this requires the expenditure of a great deal of time. The saw, when put in use, cuts from within outward, which is the safe way, but the operation requires much time to perform.

Other surgeons cut the bone-flap by means of a surgical engine, and this would seem to be the ideal method; but the handle of the cutting-saw in the engine is difficult to satisfactorily sterilize, and the engine runs the saw with a speed so great that long training and the utmost care are required to cut with safety. I have no doubt that a surgeon can train himself to work accurately with a surgical engine, but I do not believe that the implement is destined soon to come into really general use.

Recently, Dr. T. C. Stellwagen, Jr., a dentist and a student in the third-year class of the Jefferson Medical College, devised an instrument designed to cut an osteoplastic flap with a minimum expenditure of time and without inflicting any serious concussion upon the intracranial structures. After constructing this instrument, he experimented with it upon the dead body; and I joined him in some of these experiments. We determined that certain alterations were necessary in the instrument as originally constructed, and, after these had been made, we used it with much satisfaction upon a patient in the hospital of the Jefferson Medical College.

This patient was a child who was laboring under epilepsy and hemiplegia, the condition having followed an attack of diphtheria. A large-sized osteoplastic flap was cut in an extremely short space of time with ease and certainty, the chisel being lightly used to complete the division of the inner table of the skull. In using the saw, it was found to be undesirable to take it at each turn through the whole length of the half-circle. It was moved rapidly to and fro over a short portion of the length of the circle; then over another portion; next over another; and so on, until the whole had been traversed. The outer table and diploe were very readily cut through, and the inner table was satisfactorily divided. The skull was of moderate thickness. It is evident that in a very thick skull this operation would be more difficult, and would require especial pyramidal, sharp-cutting instruments, in order to make a sufficiently large opening in the bone to enable the surgeon to locate the position of the point. In fact, in none of these cases would a very narrow cutting instrument do; because such a line of incision in a bone would not admit a chisel to complete the division and to pry up the bone-flap. The flap in this case was raised with the utmost ease; and after the completion of the operation, when the bone was replaced in position, it fitted with an evenness that is not seen after the ordinary operation with a chisel.

This instrument consists of a handle and a shaft, as does an ordinary trephine. Screwing into the end of the shaft is a movable centre-pivot or point instead of the pin seen in the ordinary trephine. Dr. Stellwagen and I discovered, while working on the dead body, that a sharp and long centre-point might bore through a thin skull,—a danger which had to be obviated by modifying the instrument. The danger of such a puncture is reduced to a minimum by placing a shoulder above the point, which shoulder prevents the possibility of any deep penetration. Another method is the use of a centre-plate, with a hole for the pivot, and with sharp points on the under side, these points being driven through the scalp and a short distance into the skull, thus assuring fixation. It was this latter method which I employed in the case of the child above mentioned.

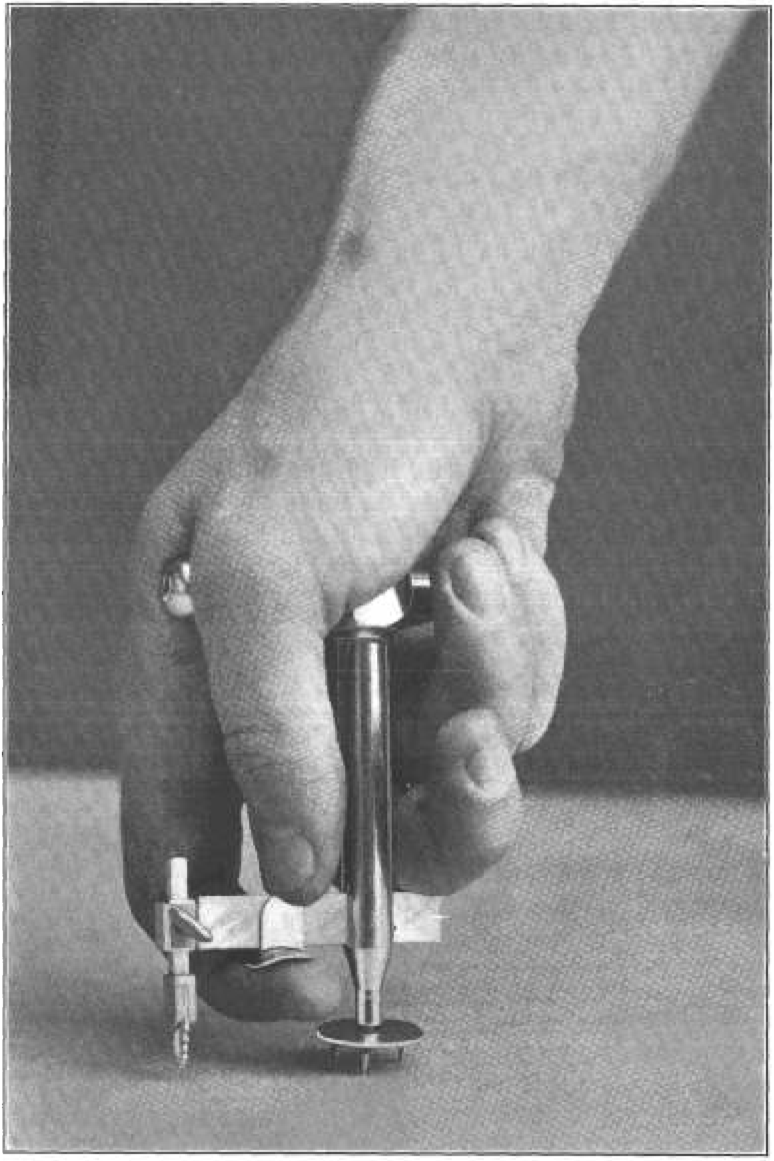

FIG. 1.—The method of using Stellwagen's trephine.

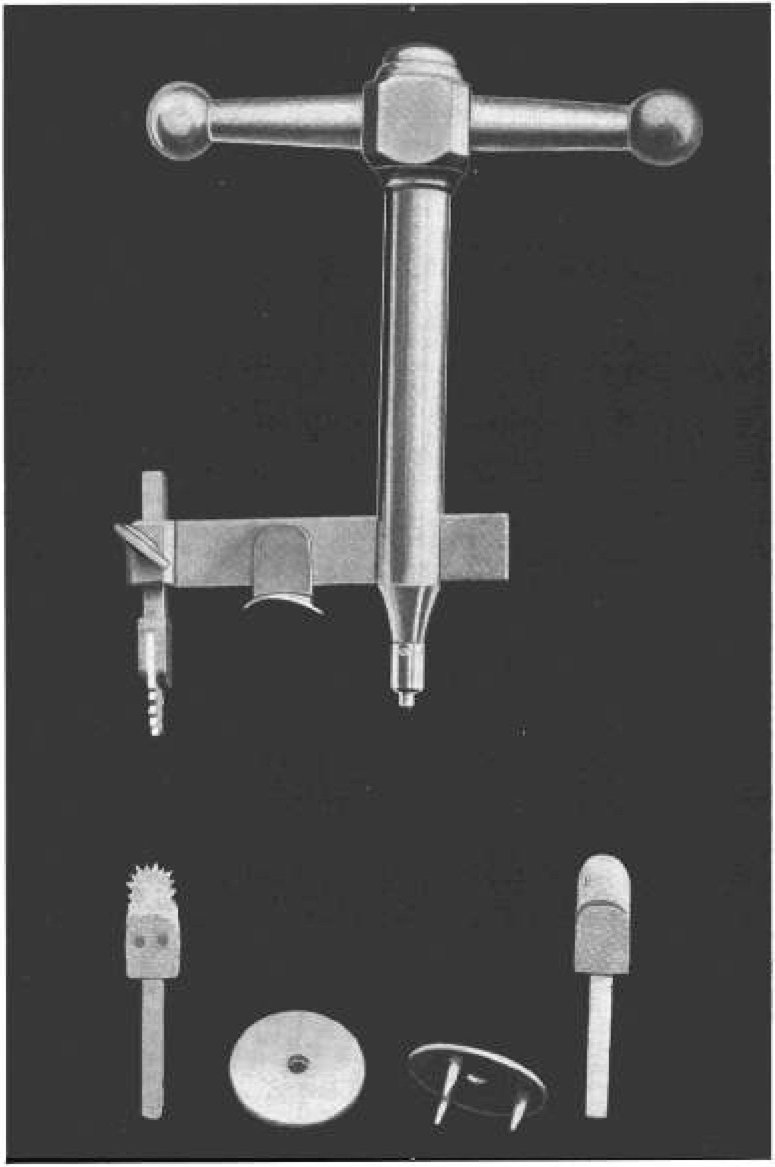

Fig. 2.—Shows the saw, the plates, and the knife, and also the instrument put together and ready for cutting the bone.

Plates containing points of several sizes should be used, the thickness of the scalp determining to some extent the length of point which it is necessary to employ. If care is taken that sufficient length is used to go but a short distance through the scalp, there is no real danger of penetrating the skull with the point.

The centre-pivot, too, may be changed, a short or a long one being used as desired. Dr. Stellwagen says that when using the centre-pivot without the plate it has been found practicable upon the cadaver to start it with an appropriate drill, sinking the hole just deep enough to prevent slipping of the instrument. Thus, a centre-pivot with a blunt end may be used for the final work. Dr. Stellwagen's description of his instrument is as follows:

The instrument, with its parts assembled ready for use, consists of a shaft pierced by an oblong quadrilateral hole, through which is passed a piece of steel at a right angle, the projection of this piece of steel being regulated by a set thumb-screw. This device enables the surgeon to cut any desired size of bone-flap. The projection-bar has a gear-hole forged in its outer or cutting end, into which fits the shaft of a movable knife and movable saws, which are used for incising the scalp and for dividing the bone. The saw may be raised or lowered to suit each case and to permit of adjustment to the inequalities of the skull, and, when once set, may be clamped by a thumb-screw. Several different forms of bone-cutting instrument were tried at various times upon the cadaver, but were discarded as being conspicuously inferior to the saw.

Fig. 1 shows the proper way to hold the osteoplastic trephine. It will be observed that the index-finger is hooked beneath the finger-guard on the bar, and not extended along the shaft of the instrument, which is the method employed in using the ordinary trephine. The manner of holding this instrument should be most particularly observed, as the success of the manipulation largely depends upon absolutely controlling, at the same time, the saw and the centre-pin. By holding it correctly, the greatest amount of power is obtained with the least resistance and the slightest pressure; thus, the control and power of the instrument are much increased.

Fig. 2 shows a knife for making the incision through the scalp and periosteum, which device was suggested by Professor W. J. Hearn. The employment of this knife shortens the time required to incise the flap and expose the bone, and it makes the scalp incision accurate; this is necessary when we are going to use a bone-cutter which moves with absolute accuracy. Furthermore, the consequent cicatrix is neater than when the incision has been made with a knife. It is difficult or impossible to make an absolutely circular cut with a knife. Even if we attempted to cut a half-circle, there would be irregularity and nicking of the edges.

Fig. 2 also represents the saw, the diagram being of the actual size. A saw of this character and size has been found to be the most successful. This saw is easily kept in order, and can be readily sharpened. It must be thick enough to cut a fairly wide groove; must have long teeth, properly set, polished, and sharpened. A saw of the character shown in the cut will make the bone section without jamming or clogging with bone dust. The surgeon should have several saws of different lengths until he becomes accustomed to the use of the instrument. When the kerf is deep and the skull thick, a longer saw may be inserted. This would prevent sudden plunging of the blade into the dura. The shoulder, which is shown in the cut, will prevent such slipping.

Fig. 2 also shows the plate, the pins of which pass through the scalp around the centre of the circle selected for operation. When they engage the bone, a few light blows of the mallet will cause their entry into the skull.

In performing the operation on the case before referred to, it was found that not only did the plate serve as a satisfactory centre for turning the instrument upon, but it also kept the scalp fixed to the bone and prevented the stripping or separation which is apt to occur, to a greater or less degree, in an ordinary osteoplastic operation. The centre-point, or pivot, of the osteoplastic trephine is introduced into the hole in the plate. This prevents slipping of the instrument. The scalp is then cut through with the knife and the bone cut through with the saw, with the least possible expenditure of labor.

Dr. Stellwagen further observes that in proportion as one's hand becomes trained in the employment of the instrument, so will the necessity for the use of the mallet and chisel decrease; as, with care, not only may the outer table and the diploe, but also a considerable thickness of the inner table, be cut through with the saw, so that with a very few light blows of the mallet upon a chisel the section may be completed. The bone should be divided well up to where the fracture is to be made through the base of the bone-flap. By so doing, a clean break can be obtained with the least possible amount of prying. In fact, it would be advisable to cut the scalp and the bone-flap rather in the shape of a clover-leaf than in that of a semicircle. It would be well for the surgeon to practise with this instrument upon the dead body before using it upon the living.

The inventor shows that this instrument can be employed for cutting a complete circle; that when it is used for this purpose, it is adaptable to the inequalities of the bone; and that a circle of practically any size can be cut with it. This one instrument, therefore, can cut a trephine opening of any size. I believe, however, that the ordinary trephine is still the instrument to be preferred in making a moderate-sized trephine opening; but if we wish to remove a very large circular piece of bone, I think that Stellwagen's instrument should be given the preference. Its inventor likewise suggests that this instrument might be used for the removal of portions of other bones.

I agree with the conclusions of the ingenious deviser of this trephine, which are that its simplicity of construction, the ease with which it can be manipulated and sterilized, its freedom from the danger of disarrangement or crippling, the speed with which it can be set, or sharpened, if need be, its adaptability to various cases, its cheapness, and the fact that either an osteoplastic flap or a circular piece can be rapidly cut by it, make it an instrument which will probably be regarded as most useful to the surgeon.